Aug. 2, 1960 J. J. FOX 2,947,846

HEATING APPARATUS

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FIG. 1.

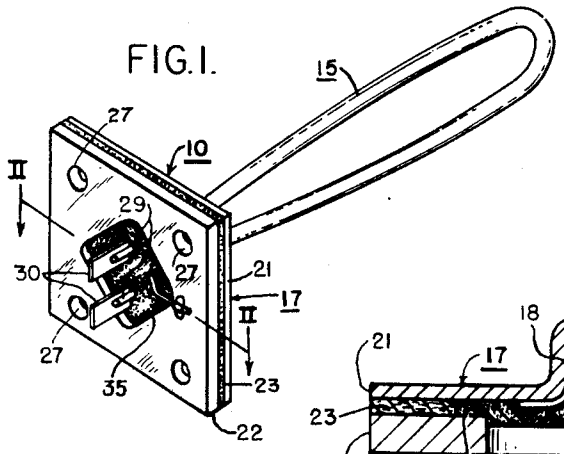
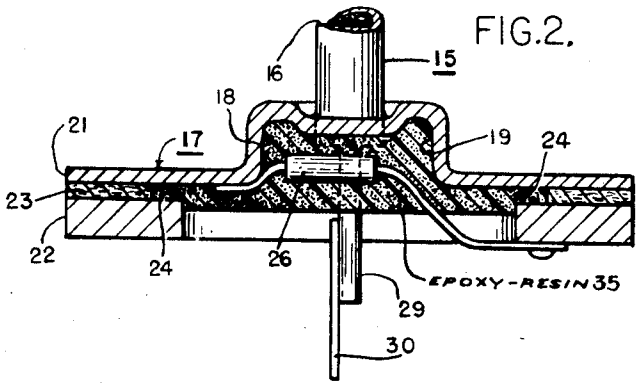


FIG. 2.



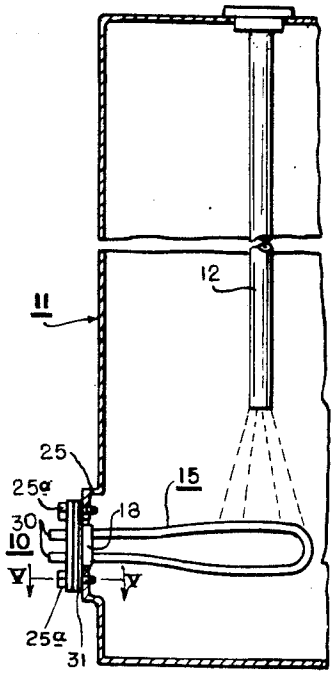
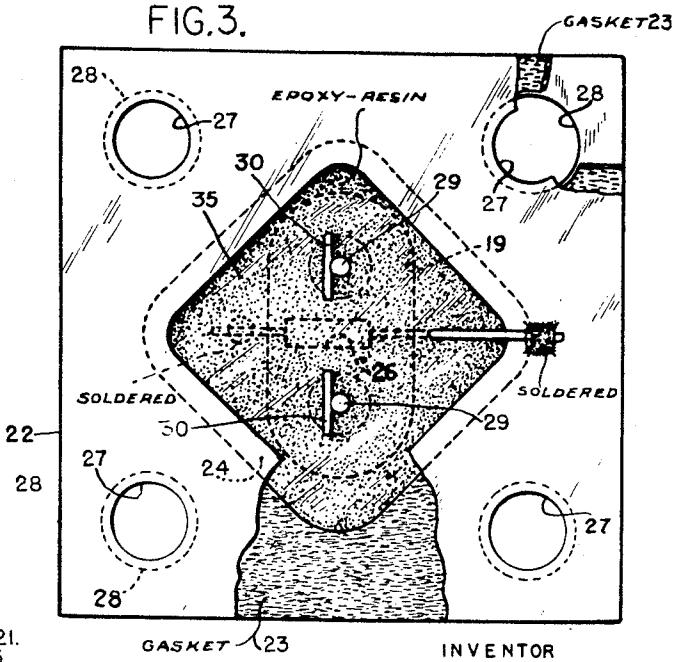


FIG. 4.

FIG. 3.



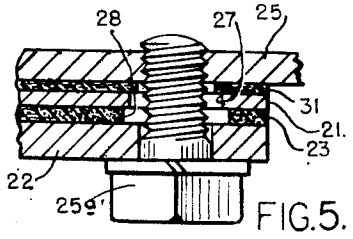


FIG. 5.

INVENTOR
JOHN J. FOX
BY Ralph T. Branch
ATTORNEY

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HEATING APPARATUS

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FIG.6.

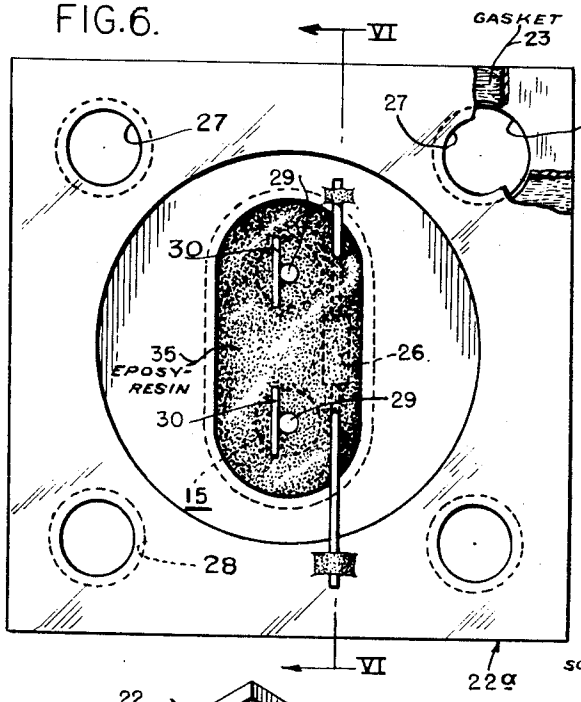


FIG.7.

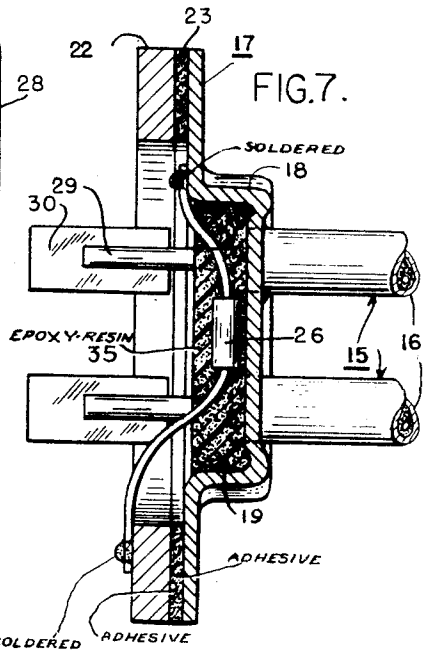
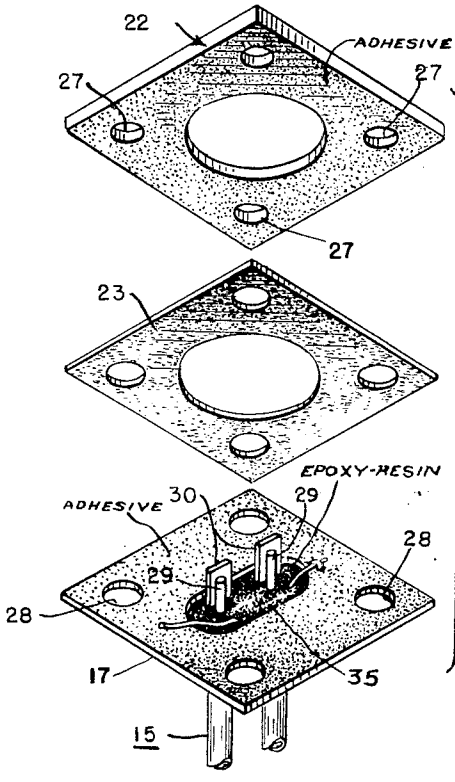


FIG.8.



INVENTOR
JOHN J. FOX
BY Ralph T. Prunch
ATTORNEY

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2,947,846

HEATING APPARATUS

John J. Fox, Lexington, Ohio, assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

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3 Claims. (Cl. 219—38)

This invention relates to immersion heaters designed for mounting in an opening in the wall of a liquid heating vessel, particularly to such heaters which utilize an electrimal resistor to protect the heater from corrosive galvanic action, and it has for an object to provide an improved assembly for a heater of this type.

Another object of the invention is to facilitate assembly of the various elements of an immersion heater and their retention in assembled relation prior to installation in a liquid heating vessel.

In accordance with the invention, the terminal portions of a tubular sheated electrical resistance heater extend through, and are secured to, a mounting plate having a central recess and a surrounding flange, the ends of the heater sheath being disposed in the recess. A clamping plate overlies the flange and is electrically insulated therefrom by a layer of electrically non-conductive insulating material interposed therebetween. An electrical resistor is disposed in the recess of the mounting plate and has a pair of electrical leads, one of which is electrically connected to the mounting plate and the other to the clamping plate. A body of thermal setting insulating material is deposited in the recess while in liquid form and when set completely covers and protects the electrical resistor, in addition to sealing the ends of the heater sheath. When the heater assembly is installed in a water tank or the like, the clamping plate and the mounting plate are usually bolted or screwed to a mounting pad on the outer surface of the tank wall, with the resistance heating element extending into the tank interior through an opening in the mounting pad. With the tank protected by a magnesium anode or the like, flow of galvanic current from the anode to the heater element will occur, unless the heater is suitably insulated electrically from the tank. Accordingly, an electrically insulating member is interposed between the heater assembly and the mounting pad, and the bolt holes through the mounting plate are of larger diameter than the aligned holes through the overlying clamping plate and interposed insulator, so that the bolts or screws will be spaced from the mounting plate as they pass therethrough. With the heater and its mounting plate thus insulated from the tank, the flow of current from the anode to the tank via the heater assembly is limited to that permitted by the electrical resistor, which provides the sole and restricted electrical path through the heater assembly to the tank.

It will be apparent that during shipping and handling of the heater assembly prior to installation, the exact correct relationship of the clamping plate and the mounting plate must be maintained, so that the mounting bolts will have proper clearance with respect to the walls of the bolt holes through the mounting plate, when installed.

The present invention provides for this necessary maintenance of correct relationship of the various parts of the heater assembly. In one form of the invention, the surfaces of the mounting plate and of the clamping plate, which engage the insulator, are coated with a liquid thermal setting material just before assembly of the parts, the material cementing the parts together when it sets. In another form of the invention, a central

opening in the insulator is larger than a corresponding opening in the clamping plate, so that when the parts are assembled, a recess or space is provided, in the plane of the insulator, between the mounting plate and the clamping plate. When liquid thermal setting material is poured into the mounting plate recess to imbed the resistor, a sufficient quantity is used to also fill the space between the mounting plate and clamping plate. When this material sets, it engages and holds the parts assembled.

The foregoing and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a perspective view of a heater assembly constructed in accordance with the present invention;

Fig. 2 is a transverse sectional view, taken along the line II—II of Fig. 1, looking in the direction indicated by the arrows;

Fig. 3 is an enlarged end view of the assembly shown in Fig. 1, with portions of the structure broken away to more clearly illustrate inventive features thereof;

Fig. 4 is a schematic view of a heating tank incorporating the heater assembly of Fig. 1;

Fig. 5 is an enlarged fragmentary sectional view, taken along the line V—V of Fig. 4, looking in the direction indicated by the arrows;

Fig. 6 is an end view in perspective of a modified heater assembly;

Fig. 7 is a vertical sectional view taken along the line VI—VI of Fig. 6, looking in the direction indicated by the arrows; and,

Fig. 8 is an exploded perspective view of the assembly of Figs. 6 and 7.

Referring to the embodiment shown in Figs. 1 to 5 inclusive, the heater assembly shown at **10** is adapted for mounting in a side wall opening in a heater tank **11**, equipped with the usual magnesium rod **12**. In the assembly **10**, the heater **15** is of the well-known tubular sheated electrical resistance type, including an electrical heating element (not shown) housed in a tubular sheath **16**, and maintained spaced therefrom by suitable insulating material packed between the heater and the sheath. A mounting plate **17** is centrally deformed, as at **18**, to provide a recess **19** surrounded by a flat flange **21**. The terminal portions of the heater **15** extend through appropriate openings in the end wall of the recess **19** and terminate in the recess. The sheath **16** is electrically connected to the recess wall, as by soldering, brazing, or the like.

A flat clamping plate **22** is disposed adjacent the flange **21** of the mounting plate and is insulated therefrom by a separator **23** of electrically non-conductive material disposed therebetween. It will be noted that both the clamping plate **22** and the separator **23** are provided with central openings, and that the opening of the separator **23** is larger than that of the clamping plate **22**, with the result that there is provided between the mounting plate flange **21** and the clamping plate **22** an inwardly opening recess **24**.

An electrical resistor **26** is positioned within the recess **19** and has its terminals connected one to the mounting plate **17** and the other to the clamping plate **22**, the connections preferably being made by soldering, brazing, or the like to provide good electrical connections between the leads and the respective plates **17** and **22**. Thus the resistor **26** and its leads provide for limited flow of electrical current from the mounting plate **17** to the clamping plate **22**, these two plates being otherwise electrically insulated from each other, as previously mentioned.

As best shown in Figs. 4 and 5, the heater assembly **10** may be mounted upon a mounting pad **25** provided in surrounding relation with respect to the opening in the side wall of the tank **11**, the assembly being held against the pad by suitable studs **25***a*. As best shown in Fig. 3, the clamping plate **22** is provided with a plurality of stud receiving holes **27** aligned with corresponding holes **28** in the underlying flange **21** of the mounting plate **17**, the holes **28** being materially larger than the holes **27**, so that the studs **25***a* will be spaced from the walls of the holes **28** in the mounting plate, thereby insuring that the latter plate is electrically separated from the studs (Fig. 5). When the assembly **10** is mounted on the pad **25**, a suitable electric insulating gasket **31** is interposed between the mounting plate and the pad, with the result that the only electrical flow path from the heater **15** to the tank **11** is via the mounting plate **17**, the resistor **26**, the clamping plate **22** and the studs **25***a*. Thus, any flow of galvanic current from the magnesium rod **12** to the heater **15** and thence to the tank **11** is controlled and limited by the resistor **26**.

It will be apparent from the above discussion that it is important that the clamping plate **22** and the mounting plate **17** be maintained in fixed position with respect to each other so that the necessary clearance between the studs **25***a* and the walls of the holes **28** will always be maintained. In order to properly fix these two plates with respect to each other, the present invention utilizes a body of suitable thermal setting insulating material **35**, for example, epoxy resin, filling the recess **19** and the space **24** between the mounting plate flange **21** and the clamping plate **22** and adhering to the flange and plate. This insulating material is deposited in the recess and space while in liquid form, and when cured it becomes permanently hardened and cements the various associated elements in fixed position. To this end, the plates **17** and **22** and the separator **23** are suitably positioned in a jig until the liquid insulating material has solidified. Thereafter, the parts may be handled normally for packaging, shipment and assembly, without danger of relative displacement.

Since the resistor **26** is positioned within the recess **19**, it is completely embedded in, and covered by, the thermal setting insulating material **35** and thereby fully protected from damage.

The resistance heating element of the heater **15** is provided with the usual terminal pins **29** extending outside the recess **19** from the terminal portions of the sheath **16**, and carrying the usual terminal strips **30**. Since the terminal portions of the sheath are disposed within the recess **19** they are hermetically sealed by the thermal setting material **35** which fills the recess.

Referring to the modification shown in Figs. 6 to 8 inclusive, this construction differs from that previously described in connection with Figs. 1 to 5 inclusive primarily in that, instead of relying upon the filling of the space **24** between the mounting plate flange **21** and the clamping plate **22** wtih thermal setting material **35** to hold the elements in alignment, the opposed surfaces of the flange **21** and clamping plate **22** are coated with the liquid thermal setting material **35** just prior to assembly and the insulator **23** then positioned between the adhesively coated surfaces and the three elements clamped together in a fixture until the two coatings have solidified, thereby cementing the parts in assembled relation. With this construction, the opening in the clamping plate may be as large as the opening in the separator **23** since the recess **24** is no longer required, resulting in a reduction in weight of the assembly, and the amount of thermal setting material **35** utilized in the recess **19** is reduced, with a consequent cost reduction.

While the invention has been shown in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. An electric heating element assembly for application to a container for heating the contents thereof, said assembly comprising: a heater including a heating element having a metallic sheath, a mounting plate supporting said heater and electrically connected with the sheath thereof and having a peripheral flange, a clamping plate overlying said flange and having a central opening therethrough, an insulator of electrically non-conductive material interposed between said flange and said clamping plate and having a central opening therethrough, said mounting plate, said clamping plate and said insulator defining a cavity in said assembly, an electrical resistor disposed in said cavity and having a pair of leads electrically connected one to the mounting plate and the other to the clamping plate, and a body of thermal setting insulating material in said cavity, said body of insulating material covering said resistor and uniting the mounting plate, the insulator, the clamping plate and the resistor in assembled relation.

2. An electrical heating element assembly comprising a tubular sheathed electrical resistance heater, a mounting plate for said heater, said mounting plate having a central recess and a surrounding flange, the tubular sheath of said heater having terminal portions extending through the plate into the recess thereof, means securing the sheath terminal portions to the mounting plate and providing an electrical flow path therebetween, electrical terminals for the resistance heater extending from the ends of said sheath and having exposed portions outside the recess, a clamping plate overlying said flange and having a central opening through which the heater terminals project, an insulator of electrically non-conductive material disposed between said flange and said clamping plate and having a central opening therethrough which is larger than the opening of the clamping plate, whereby a space is provided between the mounting plate and the clamping plate, an electrical resistor disposed in the recess and having a pair of leads electrically connected one to the mounting plate and the other to the clamping plate, and a body of thermal setting insulating material filling the recess and the space between the mounting plate and the clamping plate, said insulating material covering the resistor and adhesively uniting the mounting plate, the insulator, the clamping plate and the resistor in assembled relation.

3. An electrical heating element assembly comprising a tubular sheathed electrical resistance heater, a mounting plate for said heater, said mounting plate having a central recess and a surrounding flange, the tubular sheath of the heater having terminal portions extending through and being secured to the mounting plate and terminating in the recess, electrical terminals for the heater extending from the thermal portions of the sheath and having exposed portions outside of the recess, an insulator cemented to said flange, a clamping plate cemented to said insulator in overlying relation to the flange, said insulator and clamping plate having central openings exposing the recess of the mounting plate, an electrical resistor disposed in the recess and having a pair of leads electrically connected one to the mounting plate and the other to the clamping plate, and a body of thermal setting insulating material in said recess and completely covering the resistor.

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